

EXHIBIT C



Apr 22 2009
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**UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK**

In Re: Methyl Tertiary Butyl Ether ("MtBE")
Products Liability Litigation

MDL No. 1358
Master File C.A. No.
1:00-1898 (SAS)

This document relates to the following cases:

City of New York v. Amerada Hess Corp., et al.

04 Civ. 3417

**2nd ERRATA TO FEBRUARY 6, 2008 EXPERT REPORT OF David B. Terry, P.G.
LEGGETTE, BRASHEARS & GRAHAM, INC.**

6 Arrow Road
Ramsey, NJ 07446

Signature

April 20, 2009

Date

The numerical code used to perform the MTBE transport modeling is MT3DMS version 4.5, a modular three-dimensional multispecies transport model for simulation of advection, dispersion and chemical reactions of contaminants in groundwater systems, developed at University of Alabama for U.S. Department of Defense. All numerical transport modeling was performed in MT3DMS on the TMR model grid.

The numerical ground water flow and transport models used in this simulation were processed within the Groundwater Vistas (GV) application environment. Information needed to run simulations, including well locations and initial condition values, was developed in ArcGIS 9.3 and imported to GV using shapefiles. The files necessary to run MODFLOW 2000 and MT3DMS were then created by the GV software.

The modeling analyses performed for this assessment utilize a widely accepted, mainstream approach to modeling the migration and fate of dissolved contaminants in an unconsolidated-deposit aquifer system (Anderson, 1984, Cherry et al, 1984, Zheng and Wang, 1999). This approach has been used in numerous studies of ground-water contaminant transport on Long Island and elsewhere throughout the world.

3.0 Projection of Future MTBE Concentrations at Station 6

As described in Section 1.0, Water Supply Station 6 will be served by six existing production wells identified as Wells 6, 6A, 6B, 6C, 6D and 33. These six wells are all presently out of service, and are not currently being used as a source of water supply. The Station 6 treatment plant is scheduled to begin active service in the year 2016. As such, the primary objective of the present analysis is to project the concentration of MTBE which would occur in water produced by the Station 6 wells in 2016 and beyond.

MTBE is known to be present in ground water the Upper Glacial Aquifer in the vicinity of Station 6. The MTBE in the aquifer is derived primarily from releases of gasoline at the ground surface or in the shallow subsurface, primarily at gasoline refueling stations. As described in Section 1.0 of this report, the amount of MTBE present in gasoline in New York has varied over time, and was at its highest between 1992 and 2004, when Reformulated Gasoline (RFG) was in use in this area. The State of New York enacted a 'ban' on MTBE in gasoline effective as of January 1, 2004. After that date, gasoline is required to have no more than 0.5% MTBE content by volume (NYS Dept Ag and Markets, 2003). As a result of this pattern of MTBE use, discharges of gasoline which

occurred between 1992 and 2004 produced the highest discharge rates of MTBE loading to the subsurface and to ground water per unit of gasoline discharged.

Based on this information, the availability of information concerning ground water quality in the Station 6 area, and the availability of information concerning gasoline discharges in the Station 6 area, two analyses were developed to assess future MTBE concentrations at Station 6, both using a ground-water contaminant transport modeling approach. The first analysis (Analysis 1) used available ground-water quality information for the Station 6 area between 2004, the year in which the MTBE ban became effective, and 2008, the latest year for which water quality data was available. This information was used to develop a 'snapshot' of water quality conditions with respect to MTBE in the aquifer system at that time, and the model was then used to project the movement of ground water and migration of MTBE to the Station 6 wells in the future. The second analysis (Analysis 2) was based on the presence and location of known and reported gasoline discharge locations in the estimated future capture zone of Station 6. The migration of MTBE which is likely to have resulted from known discharge events at these sites was simulated to determine the extent to which MTBE is likely to impact future water quality conditions at Station 6. The implementation of these analyses is described in Sections 3.1 and 3.2 of this report.

3.1 Analysis 1

Analysis 1 was performed using available ground-water quality information for the Station 6 area as of the 2004 – 2008 period. The available data was used to develop a 'snapshot' of water quality conditions with respect to MTBE in the aquifer system in 2008. These data were then used as input conditions for the transport model, which is then used to project the movement of ground water and migration of MTBE to the Station 6 wells in the future.

In order to develop information on the MTBE distribution in the aquifer system as of 2008, LBG reviewed available water quality information for sample locations within the domain of the TMR model for the 2004 – 2008 period. The water quality data and the sources of the data used for this analysis are presented in Table 2. Ground-water quality data was available from New York City DEP files and other sources for water supply well and monitor well locations in Queens and Kings County. Some of the monitor well data in this area was derived from USGS water quality monitoring wells. In addition to these locations, water quality data in the period of interest was also found for various monitor wells installed at gasoline spill locations in the vicinity of Station 6.

To develop a map of the 2008 conditions, a contour map was first compiled of 2004 water quality conditions (Figure 3). The contour map is intended to represent a 'snapshot' of water quality conditions in the aquifer system during 2004. In compiling this map, ambient monitor well locations (such as DEP supply well locations and USGS monitor well locations) were considered to be representative of a broad area surrounding each well. Source data (such as monitor well data from gasoline discharge sites) were considered to represent localized conditions in the immediate vicinity of the spill site. Maximum concentration data for the period of interest were used from each spill site location, and the area of each source contour was assessed for the associated MTBE mass. The contour map compiled using this procedure was imported into the model and was assigned as input values to corresponding model cells for use as initial MTBE concentrations for a ground-water transport simulation for the 2004 – 2008 period.

The TMR model was then calibrated to determine appropriate transport parameters (such as dispersivity) in the LBG model by comparing the observed MTBE concentrations in some of the monitoring wells with simulated values. The calibration compared the 2004 and 2008 data sets. 2004 was considered an appropriate starting point for this process as an MTBE 'ban' was established in New York State beginning in January 2004. As a result, the primary bulk of MTBE mass resulting from gasoline spills to ground water would have taken place in this area by January 2004. No biodegradation of MTBE was assumed to occur during ground water transport. Yearly recharge (2004 to 2008) was calculated based on precipitation data from John F. Kennedy International Airport, New York. The recharge rates for 2004 to 2008 were based on the ratio of recharge to precipitation in 1991 calibrated MPI flow model.

The annual average pumping rates from the production wells in the model domain from 2004 to 2008 was obtained from MPI and was used to simulate transient pumping conditions during the calibration period (Table 3). A total of five (5) stress-periods were simulated, each stress period comprised of 365-days. A sensitivity analysis was performed by varying dispersivity values in the model. Sensitivity analysis was not performed on the horizontal and vertical hydraulic conductivity, storage and porosity parameters, as the flow model had already been calibrated by MPI. Dispersivity values are scale-dependent, and longitudinal dispersivity increases with increasing transport distance. The final dispersivity values (longitudinal, vertical, and transverse) obtained from the calibration exercise are summarized below. These dispersivity values are within the published ranges for similar aquifers (Gelhar and Rehfeldt, 1992; Schulze-Makuch, 2005).

Using the estimated capture zone extent, a search was made of available file information for records of known gasoline spills located within this area. Information regarding known spills was provided in electronic form, including databases and scanned reports, to LBG by MPI and the DEP. The data acquisition process for source location data is described in Cohen, 2009. A listing was compiled of such sites for which the file information indicated that significant releases of gasoline had occurred (Table 4). The available file information for each site was reviewed to determine the number of reported spills, and the date and volume of each spill. In many cases, the date and/or volume of the spills was not known or not reported. For these cases, the spill date was approximated in the analysis as being the same as the discovery or reporting date. Where the spill volume was unknown, the volume was represented as a variable that was used to conduct a sequence of potential discharge scenarios during this analysis.

Using this methodology, a total of 37 spills at 22 locations were identified as potentially significant and to be included in the analysis. It should be noted that there are many additional sites at which the file information indicated that discharges of gasoline also likely occurred. However, insufficient information was available about these sites to conclude that potentially significant discharges had occurred. As a result, these sites were not included as MTBE sources in Analysis 2. The presence of additional sites in which significant releases occurred would add additional MTBE mass to the ground-water system which is not explicitly represented in the model. There is reason to suspect that additional, unreported MTBE sources are present within the Station 6 capture zone, based on the results of a recent study of nearby Nassau County, Long Island which found the presence of MTBE ground water contamination exceeding 10 ppb at 53% of the 'non-discharge site' gasoline stations tested (NYSDEC, 2008). As such, the omission of such additional sites represents a conservative aspect of the approach in this analysis in terms of potential MTBE impacts at Station 6.

Once the source locations to be included in Analysis 2 were identified, the estimated loading of MTBE mass from spills at these sites to the ground water regime was calculated. For sites with unknown spill volumes, three scenarios were considered: gasoline spill volumes of 50 gallons, 500 gallons and 2,000 gallons, respectively. The MTBE mass for these spill volumes was calculated based on the reported average percentage of MTBE typically present in gasoline sold in New York State on the spill date (as summarized in Table 1). The extent of the MTBE contaminant plumes in ground water which could be expected to have formed in response to these spill scenarios was established using the analytical transport model ATRANS (Neville, 2005). The ATRANS model was used to determine the extent of the plume which would have

purposes of this assessment. However, a range of degradation rates was evaluated in this assessment for the more conservative release scenarios. The 50 gallon release scenario was modeled utilizing a two-year degradation half life to provide the most conservative combination of input assumptions.

A graph of the modeled concentrations of MTBE which are projected to be present in water produced at Station 6 based on the assumptions and results of Analysis 2 are summarized in Figure 8. The composite MTBE influent concentration is based on the projected concentration of MTBE which would occur at each well supplying Station 6 weighted by the percentage of the total flow to the station which is derived from the respective well. Influent concentrations were calculated in this manner for the combined flow to Station 6 under conditions both with and without including the contributions from Well 6C, to simulate the various operating conditions planned for Station 6. Individual MTBE breakthrough curves for each Station 6 well as projected by Analysis 2C are presented in Figure 9. The results of this analysis are further summarized in Section 3.3.

3.3 Summary of Projected Future MTBE Concentrations at Station 6

The results of the simulations performed in Analysis 1 and 2 both indicate that MTBE will be present at the Station 6 wells at concentrations requiring treatment when pumping of these wells is reactivated in 2016. After pumping at Station 6 is begun, MTBE concentrations are expected to be highest in the initial eight to 10 years of operation, and will then decrease over the remaining years of the assessment. The analyses both indicate that MTBE will likely remain present in the Station 6 wells at concentrations exceeding the 3 ppb treatment goal until at least 2040.

Analysis 1, which is based on the estimated distribution of known ground-water quality conditions in the aquifer system in 2004, indicates that an MTBE concentration of about 20 ppb can be expected to occur when pumping is initiated at Station 6 in 2016. The concentration at Station 6 will fluctuate somewhat with the initiation of pumping of additional supply wells associated with the Water Supply Dependability project, and will generally rise with continued pumping until peaking at about 35 ppb 2024 (Figure 6). The concentration will then generally decline after 2024, reaching 21 ppb by 2040.

The three scenarios considered in Analysis 2 show projected concentrations which are lower than those from Analysis 1 (Figure 8). For the 2,000 gallon release scenario (Scenario C), the blended MTBE concentration is projected to peak in 2015 at a concentration of 18 ppb and gradually decline until 2020 when pumping is initiated at additional DEP supply wells under the Dependability program. The MTBE

FIGURE 3
Map of 2004 Input Values
Used in Analysis 1, Layer 1

TABLE 1**MTBE CONTENT IN NEW YORK CITY AREA GASOLINE
VALUES FOR MASS ANALYSES IN THIS REPORT**

Year	MTBE Content %	Reference
1987	2.0	1, 2
1988	2.0	1, 2
1989	2.0	1, 2
1990	2.0	1, 2
1991	2.0	1, 2
1992	11.90	3
1993	11.90	3
1994	11.90	3
1995	11.90	3
1996	11.90	3
1997	11.52	3
1998	11.63	3
1999	10.72	3
2000	10.00	3
2001	10.04	3
2002	9.67	3
2003	7.37	3
2004	0.16	3
2005	0.08	3
2006	0.03	3
2007	0.08	3

weight percent assumed equal to volume percent

1. U.S. Environmental Protection Agency, 1998
2. Moyer, 2003
3. U.S. Environmental Protection Agency, 2007

TABLE 2**Analysis 1 2004 Conditions Input Data – Layer 1**

Data Point Name	Location/Address	MTBE (ppb)	Use	Data Source
S6-028	138-68 94th Ave	2,700	Monitoring	5
S6-029	244 Linden Blvd	7	Monitoring	6
S6-025	117-07 Guy Brewer Blvd	230,000	Monitoring	7
S6-026	171-07 Baisley Blvd	494	Monitoring	8
S6-022	161-51 Baisley Blvd	328	Monitoring	9
S6-020	156-07 Rockaway Blvd	90.7	Monitoring	10
S6-016	177-90 S Conduit Ave	1	Monitoring	11
S6-015	162-35 N Conduit Ave	295	Monitoring	12
S6-005	113-21 Merrick Blvd	185	Monitoring	13
S6-004	113-40 Merrick Blvd	65,900	Monitoring	14
S6-023	148-27 Liberty Ave	1,400	Monitoring	15
S6-010	105-15 Merrick Blvd	2,800	Monitoring	16
S6-003	137-10 94th Ave	1,620	Monitoring	17
S6-009	165-25 Liberty Ave	227	Monitoring	18
S6-024	107-17 178th St	0.7	Monitoring	19
<i>Additional 2008 Input Data</i>				
S6-030	108-46 Merrick Blvd	230	Monitoring	20
S6-031	188-06 Hillside Ave	1,100	Monitoring	21

1. Malcolm Pirnie NYCDEP Database
2. USGS Data from NYCDEP Dependability Joint Venture Database
3. Toxics Targeting, File mpssc_072.pdf, pages 45 through 48
4. XOM-NYC-REM-020016
5. Toxics Targeting, File mpssc_120.pdf, pages 15 through 19
6. SUN-MDL-097202
7. Toxics Targeting, File mpssc_155.pdf, pages 12 through 17 (2005 value)
8. Toxics Targeting, File mpssc_156.pdf, pages 11 through 16
9. GPMI_REM_01145
10. GPMI_REM_03992
11. XOM-NYC-REM-009498
12. XOM-NYC-REM-043877
13. XOM-NYC-REM-029844
14. Toxics Targeting, File mpssc_139.pdf, pages 10 through 15
15. AH002857
16. Toxics Targeting, File mpssc_122.pdf, pages 13 through 16
17. BPCNY0004241
18. BPCITYNY0000305
19. "Recommendation for No Further Action"; Shaw Environmental, 7/21/05
20. American Analytical Laboratories, LLC. lab ID 0802254-01A
21. Lancaster Laboratories sample no. WW5407701

TABLE 4

Summary of Discharge Sources Used in Analysis 2

siteID	year	address	2004 dist (m)	v (m/yr)	head (m)	satThick (m)	unsatThick (m)	Gasoline (gal)			MtBE %	MtBE Mass (kg)		
								run 1	run 2	run 3		run 1	run 2	run 3
s6-001	1994	138-50 Hillside Ave	531	53.15	5.35	29.21	12.66	150	150	150	11.90	49.18	49.18	49.18
s6-001	1998		309	51.59				50	500	2000	11.63	16.02	160.20	640.81
s6-001	2001		151	50.53				50	500	2000	10.04	13.83	138.30	553.20
												79.03	347.68	1,243.19
s6-002	1989	84-02 Parsons Blvd	310	20.70	5.64	20.45	35.14	30	30	30	2.00	1.65	1.65	1.65
s6-002	1990		282	20.18				50	500	2000	2.00	2.76	27.55	110.20
												4.41	29.20	111.85
s6-003	1997	137-10 94th Ave	478	68.32	5.03	32.44	8.93	50	500	2000	11.52	15.87	158.69	634.75
s6-005	2000	113-21 Merrick Blvd	177	44.40	5.25	23.54	2.29	50	500	2000	10.00	13.78	137.75	551.00
s6-005	2001		130	43.49				50	500	2000	10.04	13.83	138.30	553.20
												27.61	276.05	1,104.20
s6-006	1998	144-10 Hillside Ave	314	52.36	5.43	21.87	12.30	50	500	2000	11.63	16.02	160.20	640.81
s6-007	1989	93-05 168th St	360	24.00	5.57	19.83	11.32	50	500	2000	2.00	2.76	27.55	110.20
s6-008	1991	93-59 183rd St	774	59.60	5.32	24.21	8.60	10	10	10	2.00	0.55	0.55	0.55
s6-008	1992		684	57.06				20	20	20	11.90	6.56	6.56	6.56
s6-008	1993		612	55.64				15	15	15	11.90	4.92	4.92	4.92
s6-008	1994		547	54.70				10	10	10	11.90	3.28	3.28	3.28
												15.30	15.30	15.30
s6-009	2000	165-25 Liberty Ave	84	20.91	5.50	25.05	6.77	50	500	2000	10.00	13.78	137.75	551.00
s6-010	1996	105-15 Merrick Blvd	108	13.47	5.49	25.74	5.43	50	500	2000	11.90	16.39	163.92	655.69
s6-011	1999	109-67 Sutphin Blvd	348	69.61	4.97	29.81	4.51	50	500	2000	10.72	14.77	147.67	590.67
s6-012	1997	131-07 Merrick Blvd	263	37.59	4.33	19.73	3.56	50	500	2000	11.52	15.87	158.69	634.75
s6-012	2000		155	38.74				50	500	2000	10.00	13.78	137.75	551.00
												29.64	296.44	1,185.75
s6-013	1998	133-02 Jamaica Ave	381	63.61	5.20	32.14	12.96	50	500	2000	11.63	16.02	160.20	640.81
s6-014	1994	116-60 Sutphin Blvd	1,055	105.52	4.19	2.89	2.19	50	500	2000	11.90	16.39	163.92	655.69
s6-015	1990	162-35 N. Conduit Ave	767	54.75	1.86	32.64	3.66	50	500	2000	2.00	2.76	27.55	110.20
s6-015	2002		318	158.84				50	500	2000	9.67	13.32	133.20	532.82
												16.08	160.75	643.02
s6-016	1988	177-90 S. Conduit Ave	1,724	107.74	3.19	19.83	1.99	50	500	2000	2.00	2.76	27.55	110.20
s6-016	1993		1,296	117.84				50	500	2000	11.90	16.39	163.92	655.69
												19.15	191.47	765.89
s6-017	1997	108-01 Atlantic Ave	745	106.36	4.18	30.28	9.96	50	500	2000	11.52	15.87	158.69	634.75
s6-018	2004	154-10 Rockaway Blvd	0	0.00	1.91	25.84	1.13	50	500	2000	0.16	0.22	2.20	8.82
s6-019	1993	148-12 Rockaway Blvd	1,278	116.20	3.23	31.18	2.90	50	500	2000	11.90	16.39	163.92	655.69
s6-019	1996		971	121.38				50	500	2000	11.90	16.39	163.92	655.69
												32.78	327.85	1,311.38
s6-020	1997	156-07 Rockaway Blvd	673	96.09	2.35	24.91	1.49	50	500	2000	11.52	15.87	158.69	634.75
s6-021	1987	104-09 Atlantic Ave	1,714	100.84	4.92	32.87	10.62	50	500	2000	2.00	2.76	27.55	110.20
s6-021	1995		792	88.02				50	500	2000	11.90	16.39	163.92	655.69
s6-021	1999		388	77.67				50	500	2000	10.72	14.77	147.67	590.67
												33.91	339.14	1,356.56
s6-022	1991	161-51 Baisley Blvd	1,505	115.76	4.09	26.62	1.73	50	500	2000	2.00	2.76	27.55	110.20
s6-022	1992		1,414	117.85				50	500	2000	11.90	16.39	163.92	655.69
s6-022	1998		688	114.68				50	500	2000	11.63	16.02	160.20	640.81
												35.17	351.68	1,406.70
s6-023	1996	148-27 Liberty Ave	424	53.00	5.23	28.27	5.50	50	500	2000	11.90	16.39	163.92	655.69

DATA FOR MODELED SPILLS -- DEFENDANT WELL LOCATIONS

Defendant			Gasoline(gal)										MTBE Mass(kg)					
siteID	year	Well	spill ID	address	dist(m)	v(m/yr)	head(m)	satThick(m)	unsatThick(m)	run1	run2	run3	MTBE %	run1	run2	run3		
D-001	1999	5	97-13740	202-06 Hillside Ave	649	129.80	5.16941	25.77	23.82	50	500	2000	10.72	14.77	147.67	590.67		
D-002	1987	5	8701739	211-60 Hillside Ave	1473	86.72	6.11429	13.52	25.58	50	500	2000	2.00	2.76	27.55	110.20		
	9111141		1342		111.92	6.11429	13.52	25.58	50	500	2000	11.90	16.39	163.92	655.69			
	9203537		1342		111.92	6.11429	13.52	25.58	50	500	2000	11.90	16.39	163.92	655.69			
	0212002		107		106.89	6.11429	13.52	25.58	50	500	2000	7.37	10.15	101.52	406.09			
D-003	1990	5	9000972	211-02 Jamaica Ave	1130	80.75	5.76072	14.78	15.45	50	500	2000	2.00	2.76	27.55	110.20		
	9208777		1124		93.73	5.76072	14.78	15.45	50	500	2000	11.90	16.39	163.92	655.69			
D-004	2006	5	0512745	212-01 Hillside Ave	N/A	N/A	N/A	N/A	N/A	50	500	2000	0.08	0.11	1.10	4.41		
D-005	1993	22	9308567	118-02 Queens Blvd	46	4.16	5.42544	118.51	29.32	50	500	2000	11.90	16.39	163.92	655.69		
D-006	1994	45	9402398	138-50 Hillside Ave	548	54.87	5.34314	29.20	12.66	150	150	150	11.90	49.18	49.18	49.18		
	9409159		548		54.87	5.34314	29.20	12.66	50	500	2000	11.90	16.39	163.92	655.69			
	0101410		164		54.69	5.34314	29.20	12.66	50	500	2000	10.04	13.83	138.30	553.20			
D-007	1987	45	8708713	108-01 Atlantic Ave	1678	98.70	4.21234	29.39	10.24	50	500	2000	2.00	2.76	27.55	110.20		
	1522				95.17	4.21234	29.39	10.24	50	500	2000	2.00	2.76	27.55	110.20			
	9705122				731	91.47	4.21234	29.39	10.24	50	500	2000	11.90	16.39	163.92	655.69		
	661				94.36	4.21234	29.39	10.24	50	500	2000	11.52	15.87	158.69	634.75			
D-008	1994	45	9410736	118-11 Atlantic Ave	961	96.15	4.50799	28.98	11.31	50	500	2000	11.90	16.39	163.92	655.69		
	0308204				82	82.41	4.5659	29.22	11.41	50	500	2000	7.37	10.15	101.52	406.09		
	9709661				468	66.97	5.0353	32.44	8.92	50	500	2000	11.52	15.87	158.69	634.75		
	0205508				144	71.99	4.99567	32.12	9.48	50	500	2000	9.67	13.32	133.20	532.82		
D-012	1997	22	9712141	118-29 Queens blvd.	45	6.47	5.4	116.65	21.35	50	500	2000	11.52	15.87	158.69	634.75		
D-013	1989	39	8903947	241-15 Hillside Ave.	2397	159.92	9.5	9.20	21.05	50	500	2000	2.00	2.76	27.55	110.20		
	9901132				841	168.25	9.5	9.20	21.05	50	500	2000	10.72	14.77	147.67	590.67		
	2005				0412716	N/A	N/A	N/A	N/A	N/A	50	500	2000	0.08	0.11	1.10	4.41	
																		17.63
D-014	1997	45	9709205	133-02 Jamaica Ave	448	64.06	5.2	32.02	12.98	50	500	2000	11.52	15.87	158.69	634.75		
	9806342		133-02 Jamaica Ave	380	63.32	5.2	32.02	12.98	50	500	2000	11.63	16.02	160.20	640.81			
	0003462		133-02 Jamaica Ave	246	61.66	5.2	32.02	12.98	50	500	2000	10.00	13.78	137.75	551.00			
D-015	1989	45	8907942	138-50 Jamaica Ave.	895	59.71	5.28	29.05	11.95	50	500	2000	2.00	2.76	27.55	110.20		
	9505050				138-50 Jamaica Ave.	491	54.58	5.28	29.05	11.95	40	40	40	11.90	13.11	13.11	13.11	
	1998				9801767	138-50 Jamaica Ave.	317	52.81	5.28	29.05	11.95	50	500	2000	11.63	16.02	160.20	640.81
							31.89	200.87	764.13									

TABLE 5